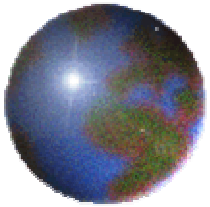


Triggering MICE: Very Preliminary Thoughts

Steve Kahn
Brookhaven National Lab

What Should the Triggering Do?

- We should like to trigger on a *good muon track.*
  - We do not want to waste time writing out TPG or SciFi hits if the track is not a good muon candidate.
    - Is this true? Is there time to write out everything to a buffer and not worry about triggering at all?
      - For data rate considerations alone we could take everything.
  - We also don't necessarily want to trigger if the beam conditions are bad for some reason
    - Beam is mis-steered on a particular beam cycle.
  - We may want to trigger an a particular part of the phase space.
    - This may or may not be possible.

Data Rates

Detector	Data Rate
TPG	10 Mb/s
SciFi	40 Mb/s
TOF	0.5 Mb/s

From E. Radicioni's Transparency

- This data rates are not excessive

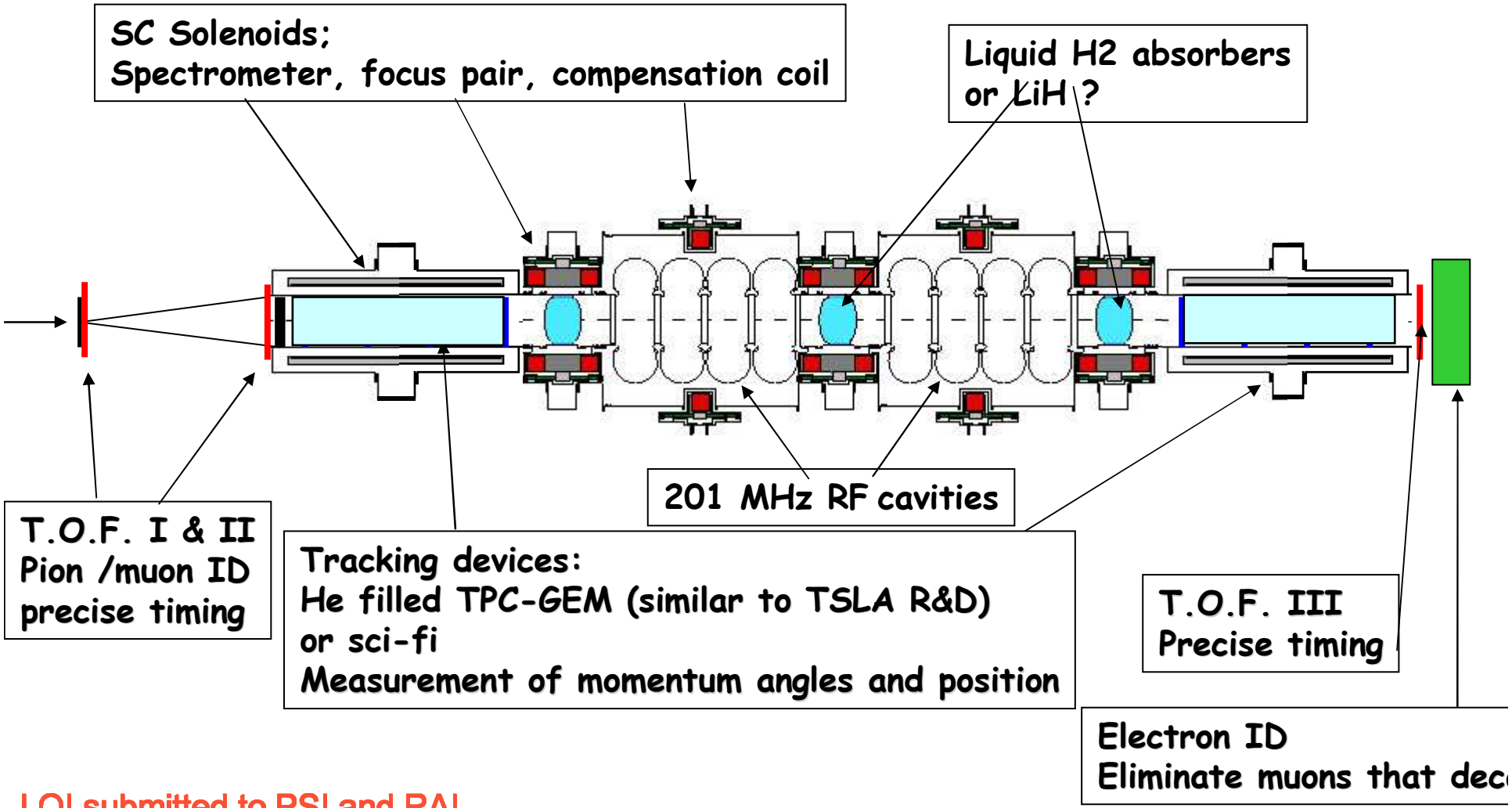
Why Trigger?

- We could trigger to reduce the background.
  - TOF 1 and 2 can verify a muon. This signal can be used to trigger a tight time gate for other detectors.
    - In this case detectors would only be sensitive to background Xrays during the minimum gated time.
    - This will be the triggering scheme that will be pursued.

10% cooling of 200 MeV muons requires ~ 20 MV of RF

single particle measurements =>

measurement precision can be as good as $\Delta (\varepsilon_{out}/\varepsilon_{in}) =$

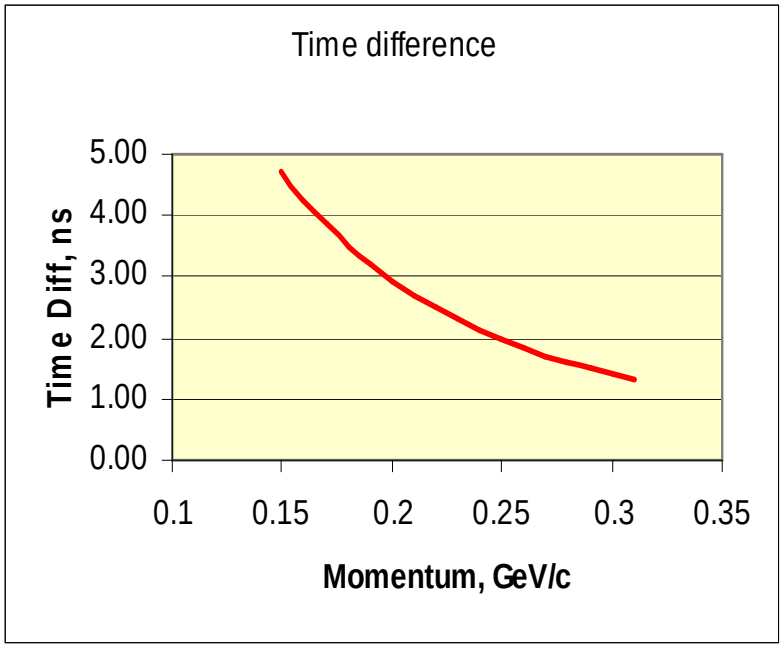


LOI submitted to PSI and RAL.

The two labs agreed to collaborate and RAL encourages submission of proposal. 2002: prepare prop

Triggering Using TOF System

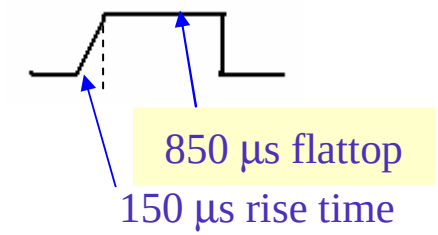
- The figure shows the time difference between μ and π with specified momentum to traverse 10 m.
- The TOF time resolution is expected to be better than 200 ps. This is adequate to distinguish μ from π.
- Good Muon can be defined as a coincidence.
  - **TOF1 * TOF2** with proper time delay



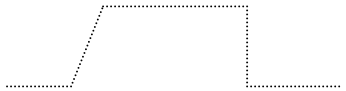
Data Taking Scenario

- RF Duty Cycle: $10^{-3} \rightarrow$ 1 ms in each second
  - 150 μs rise time required for turn on of RF.

1 Hz:

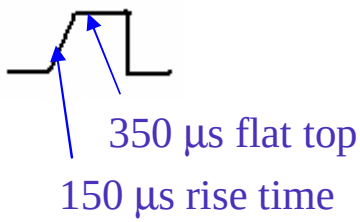


+



RF off *flat top*
For background studies

2 Hz :

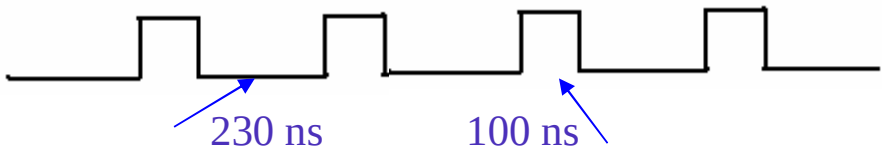


- The choice of 1Hz or 2 Hz depends on how large the buffers are or what electronics are used.

From V. Palladino

Data Taking Scenario (cont.)

- ISIS Bunch Structure

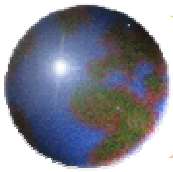


- In 850 μs there are 2600 bunches
- Assuming ~1 μ/bunch in TOF 1

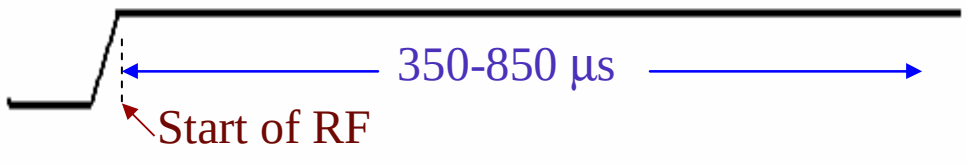
  → 0.25 μ/bunch in TOF 2 (geometric factor)

  → 0.04 μ/bunch in phase w/RF (factor 1/6)

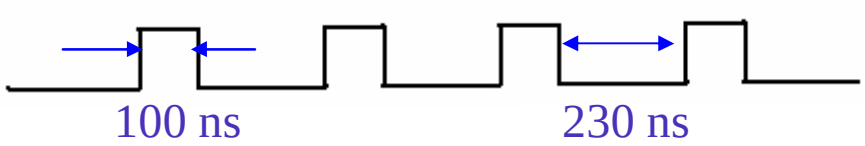
- 2600 bunches gives 100 μ/sec
- For 1% errors we need 10^5 muons
- Typical run would be 1000 sec.



$RF_{cooling}$



RF_{ISIS}



μ Bunch train

Typical μ

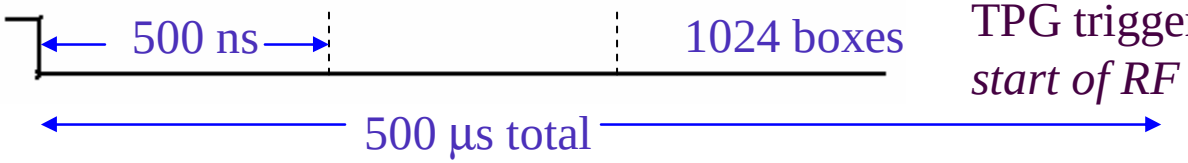
TOF1

TOF sets a starting trigger signal with a resolution of ~100 ps

SciFi

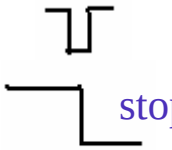
The SciFi is gated for 20 ns against TOF start trigger

TPG



TPG triggered off *start of RF*

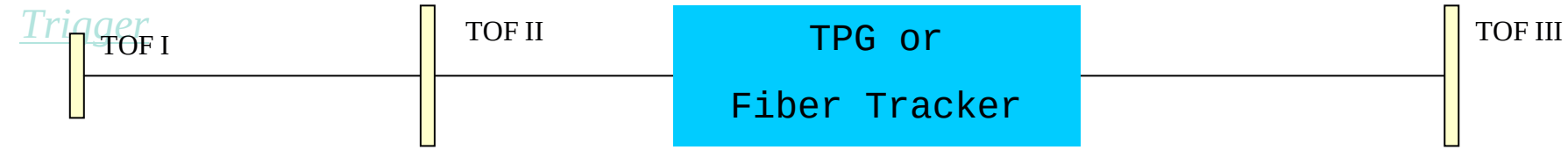
$\check{C}_{down}$, E_{cal}

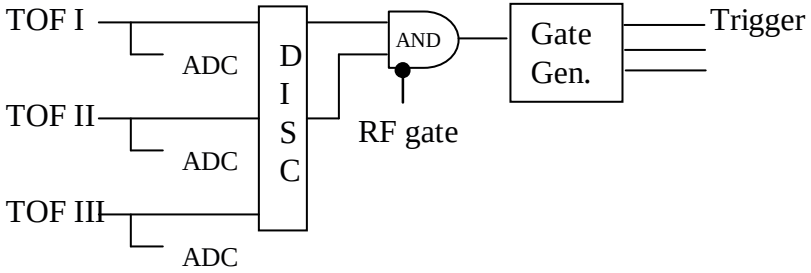


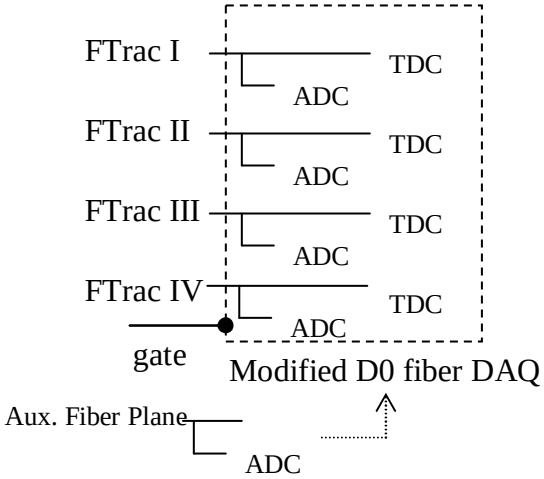
From V. Palladino

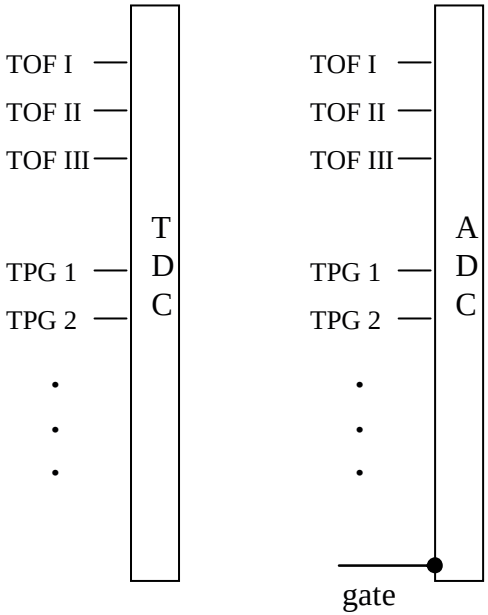
Specific Detector Comments

- SciFi Detector.
  - The minimum required active time is 20 ns.
  - This 20 ns gate can be triggered by the TOF.
    - This will specify where in the 100 ns bucket the μ is.
    - The SciFi need not be active during the whole RF cycle, which will reduce the background from Xrays.
- TPG Detector.
  - The TPG would trigger off the *start of RF* signal.
  - It would stay active for 500 μs.
  - The TPG is less sensitive to background.
- The Č and E-cal are reasonably fast and could be triggered in a manner similar to the SciFi.
  - The Č is fast enough for a 10 ns gate.(?)


Trigger
TOF I
TOF II
TPG or
Fiber Tracker
TOF III


TOF I
ADC
TOF II
ADC
TOF III
ADC
D
I
S
C
AND
RF gate
Gate
Gen.
Trigger


FTrac I
TDC
ADC
FTrac II
TDC
ADC
FTrac III
TDC
ADC
FTrac IV
TDC
ADC
gate
Modified D0 fiber DAQ
Aux. Fiber Plane
ADC


TOF I
TOF II
TOF III
TPG 1
TPG 2
T
D
C
TOF I
TOF II
TOF III
TPG 1
TPG 2
A
D
C
gate

From K. Lee